

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

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NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year) 07.10.2004

Applicant's or agent's file reference
P14301WO

IMPORTANT NOTIFICATION

International application No.
PCT/GB 03/02821

International filing date (day/month/year)
01.07.2003

Priority date (day/month/year)
04.07.2002

Applicant
R. F. ENGINES LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P14301WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB 03/02821	International filing date (day/month/year) 01.07.2003	Priority date (day/month/year) 04.07.2002
International Patent Classification (IPC) or both national classification and IPC H03H17/02		
Applicant R. F. ENGINES LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 30.12.2003	Date of completion of this report 07.10.2004
Name and mailing address of the International preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Trafidlo, R Telephone No. +49 89 2399-2672



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/GB 03/02821**

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*):

Description, Pages

1-3, 5-16 as originally filed
4 received on 01.06.2004 with letter of 28.05.2004

Claims, Numbers

1-4 as originally filed
5-10 received on 01.06.2004 with letter of 28.05.2004

Drawings, Sheets

1/25-25/25 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☒ the claims, Nos.: 11
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-10
	No: Claims	
Inventive step (IS)	Yes: Claims	1-10
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-10
	No: Claims	

2. Citations and explanations
see separate sheet

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EXAMINATION REPORT - SEPARATE SHEET**

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Re Item V

1. Reference is made to the following documents:

D1: WO 01 65692 A (R F ENGINES LTD) 7 September 2001 (2001-09-07) cited in the application

2. Document D1, which is considered to represent the most relevant state of the art, discloses (cf. D1: abstract, figure 1 and 5):

Apparatus for frequency content separating an input signal, said apparatus comprising:

-- a plurality of frequency separating stages (A, B, C), each frequency separating stage including at least one complex frequency shifting converter (CDC, CUC, ICDC, ICUC) operable to receive a complex input signal representing an input bandwidth extending from $-F_s/2$ to $+F_s/2$ and to output a first frequency shifted complex output signal representing an upper portion of said input bandwidth and a second frequency shifted complex output signal representing a lower portion of said input bandwidth.

from which the subject-matter of claim 1 differs in that:

At least one complex frequency shifting converter in at least one of the plurality of frequency separating stages is a tuned complex frequency shifting converter having a frequency shifting characteristic operable to output a frequency shifted complex output signal representing a portion of the input bandwidth centered other than at $-F_s/4$ or $+F_s/4$.

The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as providing an efficient apparatus for frequency content separation capable of extracting frequency bands of different width, unevenly distributed across the spectrum.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons: none of the available prior art documents disclose or suggest using tuned complex

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frequency shifting converters in a multistage frequency separating apparatus to allow varying of the centre frequency of the extracted band and its bandwidth.

3. Claims 2 - 9 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

4. Claim 10 claims a method of designing an apparatus as defined in any of claims 1 to 9 to select operating characteristics of frequency separating stages, and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Whilst the frequency separating stages using their frequency shifting complex converters may separate out particular target bandwidth portions of the input to the system, the requirement to provide a hardware efficient system will to some degree restrict the points about which separated bands may be centred and the widths of those bands such that in preferred embodiments it is advantageous to provide that output signals are passed through respective fine tuning stages that serve to extract the target carrier signals.

Such fine tuning stages may be provided with relatively long delay lines used as filters that may more flexibly tune to a particular frequency and with a particular frequency response as required by the target carrier signal being extracted.

The invention also provides a method of selecting operating characteristics of a plurality of frequency separating stages as set out in the accompanying claims.

Example embodiments will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a block diagram of a frequency separating tree system;

Figure 2 schematically illustrates frequency band splitting;

Figure 3 is a block diagram of a complex down-converter (CDC);

5. Apparatus as claimed in any one of the preceding claims, wherein said tuned frequency shifting complex converter includes a local oscillator operable to generate one or more time varying coefficient signals by which sample values forming said input signal are multiplied as part of frequency separation.

6. Apparatus as claimed in claim 5, wherein said local oscillator is operable to generate a selectable one of a plurality of different streams of time varying coefficient signals each corresponding to a different local oscillator frequency and operable to separate a different portion of said input bandwidth.

7. Apparatus as claimed in any one of the preceding claims, wherein said tuned frequency shifting complex converter is one of:
a tuned complex up-converter; and
a tuned complex down-converter.

8. Apparatus as claimed in any one of the preceding claims, wherein one or more of said plurality of frequency separating stages includes a complex up-converter and a complex down-converter pair that together are operable to separate a complex input signal into an upper frequency portion and a lower frequency portion being substantially contiguous and of equal size.

9. Apparatus as claimed in claim 3, wherein said plurality of output signals are passed through respective fine tuning stages that serve to extract said target carrier signals.

10. A method selecting operating characteristics of a plurality of frequency separating stages within an apparatus as claimed in any one of claims 1 to 9, said method comprising the steps of:

determining whether two target signals require extracting from any final frequency separating stage, and if so providing two fine tuning elements for those final frequency separating stages;

determining a number of frequency separating stages required to separate all target signals;

generating local oscillator coefficient values for each frequency separating stage;

5 generating fine-tuning local oscillator coefficient values for any fine tuning elements within final frequency separating stages; and

selecting a band shaping filter to be applied to each target signal.